gave full and ample warnings of Tuesday night's gale which swept over the lakes with such sad results to life and property. There can be no doubt but that this one warning alone has repaid the country for the outlay of the entire annual appropriation granted by Congress for the maintenance of the service. Too much credit can not be given to the Chief of the Weather Bureau and the officers in charge of lake stations for the energetic and well advised measures taken to warn vessels of the approach of the late gale and its probable severity.

Editorial from the Inter-Ocean, Chicago, Ill., September 14, 1900.

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Simple justice demands public recognition of the efficiency of the Chief of the Meteorological Bureau and his staff. They have demonstrated their usefulness in such manner as to set at rest all doubt with regard to the wisdom the Government has displayed in maintaining the weather service against all opposition and all ignorant prejudices.

The heated period which prevailed almost continuously over the eastern part of the United States during July and August was permanently broken by the tropical storm described herein, and advices to this effect were given in a special bulletin which was issued the morning of September 12, 1900.

From the 15th to the 18th a cool wave, which produced the first frost of the season, extended from the Northwestern States over the Lake region, and frost occurred in the Northwestern States from the 25th to the 27th. Warnings of these frosts were distributed over the districts visited. In the north Pacific coast States the occurrence of frost on the 19th, 24th, 25th, 27th, and 28th was, as a rule, predicted.

On the 23d and 24th snow fell in the mountains and hills about Salt Lake City, Utah. The Weather Bureau observer at Cheyenne, Wyo., reports that snow fell as far west as Evanston, and that a depth of 13 inches was measured at Sherman the morning of the 25th. On the 24th railroad contractors working on a big contract on Sherman Hill were specially informed by the Weather Bureau observer at Cheyenne of the approaching storm.

Toward the close of the month damage was caused by a rapid rise in the Colorado, Brazos, and Trinity rivers, Texas. Towns on the Colorado, south of Austin, were warned of the impending flood, and the inhabitants of the bottom lands of the Trinity were warned in time to escape. Interests along the Brazos River were also warned, on the 27th, that the rise would continue during the next few days and overflow low land.

CHICAGO FORECAST DISTRICT.

The principal meteorological feature was the passage of the Galveston storm across the lakes. On the morning of the 11th this storm was central over Iowa, and its characteristics were such that it was deemed advisable to at once send storm warnings to upper lake ports. The warnings were made especially strong because lake captains do not expect severe storms during the month of September, and stated that "the storm would be dangerous for practically all vessels to leave port."

The great force of the storm was not felt on Lake Superior, but it was not deemed advisable to take any chances on the direction of the storm's movement, and consequently all ports received equal warnings. Some of the lake stations reported higher wind velocities than any reported previously for several years, and the fact that few wrecks and casualties occurred was undoubtedly due to the advices issued by the Weather Bureau.

A storm of considerable energy moved eastward across the upper Lake region during the 15th and 16th. On the 15th warnings for this storm were ordered at all upper lake ports, except at Chicago and Milwaukee.

A general frost condition moved from the extreme northwest over the upper Mississippi Valley and the western Lake region from the 15th to the 18th. As this was the first frost of the season, the warnings were probably of great value. Frost warnings were also issued on the 25th, 26th, and 27th, in advance of frost which occurred in the Northwest and the northern Lake region.—*H. J. Cox, Professor of Meteorology.*

SAN FRANCISCO FORECAST DISTRICT.

No special forecasts or warnings were issued during the month.—*G. H. Willson, Local Forecast Official.*

PORTLAND, OREG., FORECAST DISTRICT.

The only storm during the month attended by high winds passed over the northern portion of the district on the 22d.

The storm struck the Gulf of Georgia with great violence and several small steamboats were capsized and sunk and their occupants were undoubtedly drowned. A dispatch from Tacoma says: "Steamboat men all say that the storm last night was the worst for many years, and the little damage done to shipping was due to danger warnings being displayed foretelling the storm." Frosts occurred on the 19th, 24th, 25th, 27th, and 28th, which were generally forecast.—*A. B. Wollaber, Acting Forecast Official.*

HAVANA, CUBA, FORECAST DISTRICT.

Stations in Cuba, Jamaica, Haiti, Turks Island, Santo Domingo, and Porto Rico and shipping interests were fully informed of the location, character, and course of the tropical storm which moved westward over the Caribbean Sea during the first three days of September and crossed northward over the western central part of Cuba during the 4th. The storm was not severe in the West Indies although the rains were, in places, torrential. At Santiago, Cuba 24.34 inches of rain fell from 8 a. m. of the 3d to 8 p. m. of the 7th, of which amount 12.58 inches fell in the twenty-four hours ending 8 a. m. of the 4th.—*W. B. Stockman, Forecast Official.*

AREAS OF HIGH AND LOW PRESSURE.

During the month there were nine highs and nine lows with sufficiently definite progressive movement to admit of their being charted. (See Charts I and II.) A brief description of their movements and more prominent characteristics follows herewith:

Highs.—It is particularly worthy of mention that none of the highs moved south of the thirty-ninth parallel except a minor offshoot of the one charted as No. VII. All except Nos. I, VI, VII, and the smaller section of No. IX originated in the Province of Alberta, N. W. T. Nos. III, IV, and IX moved almost directly eastward over Canada to the Atlantic Ocean. No. IX was joined over central Ontario by another section which had moved up from central Illinois. Nos. II and VIII also moved eastward over Canada, first taking a southeasterly course through the Dakotas, and thence easterly. No. I originated on the north Pacific coast, moved southeastward to Nebraska, and thence eastward to the southern New England coast, making on the way a detour through the Lake region. No. VI moved along the Pacific coast from northern California through Washington. No. VII originated in Wyoming, moved eastward to the upper Ohio Valley, then turned sharply northward to Ontario, again eastward to the Maine coast, and finally northeastward into the Atlantic by way of St. Johns, N. F.

During the earlier days of the month a high area also set-

tled off the middle and south Atlantic coasts, causing a continuance over the Atlantic States of the abnormally warm weather which had already prevailed for an almost unbroken period of over two months.

Movements of centers of areas of high and low pressure.

Number.	First observed.			Last observed.			Path.		Average velocities.	
	Date.	Lat. N.	Long. W.	Date.	Lat. N.	Long W.	Length.	Duration.	Daily.	Hourly.
High areas.		°	°		°	°	*Miles.*	*Days.*	*Miles.*	*Miles.*
I	1, a. m.	47	123	5, p. m.	42	70	2,950	4.5	656	27.3
II	4, p. m.	53	114	8, a. m.	45	64	2,475	3.5	707	29.5
III	7, a. m.	52	114	11, p. m.	46	60	2,575	4.5	572	23.8
IV	12, a. m.	52	114	16, a. m.	46	60	2,660	4.0	665	27.7
V	14, a. m.	54	114	21, a. m.	48	52	4,285	7.0	612	25.5
VI	19, p. m.	41	124	21, p. m.	48	122	520	2.0	260	10.8
VII	20, a. m.	43	109	26, a. m.	48	52	3,625	6.0	604	25.2
VIII	24, p. m.	53	114	29, a. m.	46	60	2,885	4.5	641	26.7
IX	29, a. m. 29, p. m.	52 41	114 88	3, a. m.*	48	52	3,000 2,150	4.0 3.5	750 614	31.2 25.6
Sums							27,125	43.5	6,081	253.3
Mean of 10 paths							2,712		608	25.3
Mean of 43.5 days									624	26.0
Low areas.										
I	1, a. m.	15	67	12, p. m.	46	60	5,200	11.5	452	18.8
II	1, a. m.	44	103	2, a. m.	48	89	725	1.0	725	30.2
III	3, a. m.	46	118	7, a. m.	48	52	3,295	4.0	824	34.3
IV	10, a. m. 18, a. m.	21 51	82 120	17, a. m.	46	60	3,150 3,250	7.0 4.0	450 813	18.8 33.9
V	11, a. m.	54	114	15, a. m.	48	52	2,935	4.0	734	30.6
VI	14, a. m.	22	60	19, a. m.	48	52	2,575	5.0	515	21.5
VII	15, a. m. 17, a. m.	44 33	116 115	24, a. m.	48	52	3,975 3,825	9.0 7.0	442 546	18.4 22.8
VIII	23, a. m.	51	120	25, p. m.	48	86	2,130	3.5	609	25.4
IX	26, p. m.	54	114	30, a. m.	49	88	1,220	3.5	349	14.5
Sums							32,280	59.5	6,458	269.2
Mean of 11 paths							2,935		587	24.5
Mean of 59.5 days									543	22.6

*October.

Lows.—With the exception of those of tropical origin, none of the low centers appeared south of the forty-second parallel except the lower section of No. VII, which was first noticed in southwestern Arizona. In fact they were for the most part limited to that portion of the country north of the forty-fifth parallel. Their mean direction of movement was almost due eastward or east-southeastward, and three of them, Nos. II, VIII, and IX, disappeared to the northeastward after leaving Lake Superior. No. II was a depression that had remained practically stationary over the extreme northwest since the morning of August 28, and it was not until the morning of September 1 that any progressive tendency developed. There was also a depression over the northwest from the evening of the 6th until the evening of the 10th, or until the tropical storm charted as No. I had turned eastward while leaving northern Kansas.

Of the three tropical storms—Nos. I, IV, and VI—No. I stands forth most prominently as the destructive hurricane of the early days of the month which created such terrible devastation and destruction at Galveston, Tex. A full history of this storm appears in another portion of this REVIEW. No. IV was a moderate disturbance, without destructive energy, which first appeared south of Cuba on the morning of the 10th. It reached the Louisiana coast by the evening of the 12th, and then recurved to the northeastward, reaching the southern New England coast on the morning of the 16th; it then moved northward to eastern Ontario, where it was joined by another depression of nearly equal intensity; it continued eastward in the track of the latter through Cape Breton Island into the Atlantic. No. VI was first reported by the captain of the steamship *Hungaria* in latitude 21°, longitude 60°, on the 13th. It moved slowly northward, apparently passing westward and close to the islands of Bermuda on the evening of the 17th. It moved more rapidly during the night of the 17th, and on the morning of the 18th was evidently central a short distance southeast of the southern New England coast, from whence it turned northeastward along the coast, passing off the Newfoundland coast on the morning of the 19th. This storm caused only moderately high winds on the New England and middle Atlantic coasts, but was evidently much more severe in its effects over its ocean path.—*H. C. Frankenfield, Forecast Official.*

RIVERS AND FLOODS.

Stages of water satisfactory to navigational interests prevailed during the month over the entire length of the Mississippi River. There was a fall of a few feet south of the mouth of the Ohio River, while to the northward there was a rise of a foot or more except between Cairo, Ill., and the mouth of the Missouri River, where there was but little change, the fall in the Missouri counterbalancing the rise which came down from the upper Mississippi. There was also a general fall of 1.5 to 3.5 feet in the Ohio River, the maximum fall occuring over the lower river. The Tennessee River fell considerably and navigation was suspended on its upper portion for the first few days of the second decade of the month, the river at Chattanooga, Tenn., reaching the lowest stages recorded for corresponding periods since 1883.

Nothing further of interest was noted except in Texas, where heavy rains from the 20th to the 23d, inclusive, and later in northwestern Texas, caused very rapid, and in many places, destructive floods over the Brazos, Trinity, and Colorado river districts. Along the Brazos River excellent opportunity was afforded to test the efficiency of the newly organized flood service. Warnings of danger-line stages at Waco, Tex., were issued on the 24th, and for that portion of the river between Waco and Hempstead, Tex., on the 27th. These warnings, which were issued from the Weather Bureau Office at Galveston, Tex., were accurate and timely, and the new service has been the subject of much favorable comment by those who are particularly interested. The greater portion of the damage done was unavoidable, and was limited chiefly to the loss of cotton and other field crops in the lowlands. In the vicinity of Fort Worth, Tex., where the rainfall was torrential, the Trinity River rose 20 feet during the night of the 20th. On the 27th a great volume of water came out of the West Fork of the Trinity, and on the 28th the main river at Fort Worth reached a height of at least 35 feet, and was more than one mile wide. One life was lost near Dallas, Tex., and the damage by overflow to crops, buildings, and railroads amounted to perhaps $100,000. Conditions along the Colorado River were very similar, and while no estimates of the damage have been received, it is very probable that the total amount of the loss will be fully as great, if not greater, than that along the Trinity River.

The highest and lowest water, mean stage, and monthly range at 129 river stations are given in Table XI. Hydrographs for typical points on seven principal rivers are shown on Chart V. The stations selected for charting are: Keokuk, St. Louis, Memphis, Vicksburg, and New Orleans, on the Mississippi; Cincinnati and Cairo, on the Ohio; Nashville, on the Cumberland; Johnsonville, on the Tennessee; Kansas City, on the Missouri; Little Rock, on the Arkansas; and Shreveport, on the Red.—*H. C. Frankenfield, Forecast Official.*